MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

BEM1014 – MATHEMATICS

(All sections / Groups)

14 OCTOBER 2019
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 4 pages excluding the cover page.
2. Attempt ALL FOUR questions.
3. Write your answers in the Answer Booklet provided.
4. The mathematical formulae are attached at the end of this question paper.

Question 1 (15 marks)

a) Solve for x: $x+8=2+\sqrt{2x+12}$ (5 marks)

b) Suppose consumers will demand 30 units of Gap's T-shirt when the price is RM 12 per shirt and 22 units when the price is RM 16 each. Find the demand equation assuming that it is linear.

(4 marks)

c) A division of Maxwell Enterprises produces "Personal Income Tax" diaries. Each diary sells for \$18. The monthly fixed costs incurred by the division are \$35,000 and the variable cost of producing each diary is \$4. Find the break-even point for the firm.

(6 marks)

Question 2 (25 marks)

A company has two different locations to assemble three different models of PCs. The table below summarize the daily production capacity, the minimum number of each type needed and the daily operating costs for each location.

	Location 1	Location 2	Minimum number
Model 1	60	60	2400
Model 2	40	80	2000
Model 3	60	40	1800
Cost	\$16,000	\$12,000	

Let x represent the number of operation days at Location 1 and y represent the number of operation days at Location 2.

a) Formulate a linear programming (LP) problem that minimizes the cost. (5 marks)

b) Find the number of days that each location needs to operate in order to fill the orders at minimum cost.

(20 marks)

Continued...

Question 3 (25 marks)

a) Suppose an initial investment grows from \$330 to \$600 over five years. Find the nominal rate compounded monthly and the equivalent effective rate.

(7 marks)

b) Find the present value of \$5000 due in 3 years if the interest rate is 6.75% compounded monthly.

(5 marks)

c) Clara needs RM 9,000 in 8 years. What amount can she deposit at the end of each quarter at 8% interest compounded quarterly so she will have her RM 9,000?

(5 marks)

d) A person establishes a retirement plan; an immediate deposit of \$10,000 and quarterly payments of \$1,500 at the end of each quarter into a savings account that earns 5% compounded quarterly. What is the amount of the investment after 21 years?

(8 marks)

Question 4 (35 marks)

a) Find $f'(x)$ if $f(x)=\dfrac{5x-4}{x+6}$. (5 marks)

b) Find an equation of the tangent line to the curve $y=4x^2+5x+6$ at (1, 15).

(4 marks)

c) Evaluate the following integrals:

i) $\int x\sqrt{3x^2+7}\,dx$ (6 marks)

ii) $\int_1^2\left(e^x+\dfrac{9}{x}+2\right)dx$ (5 marks)

d) Consider the function:

$$f(x,y)=5x^2-5y^2+2xy+34x+38y+12$$

i) Find the first partial derivatives of the function. (4 marks)

ii) Find the critical point of the function. (6 marks)

iii) Is the critical point a relative extremum point? Explain. (5 marks)

End of Questions.

FORMULAE

Simple Interest

(i) Interest, $I = Prt$ (P = principal, r = interest rate, t = number of years)

(ii) Accumulated amount, $A = P(1 + rt)$

Compound Interest

(i) Accumulated amount, $A = P(1+i)^n$, where $i = \dfrac{r}{m}$, and $n = mt$

(m = number of conversion periods per year)

(ii) Present value for compound interest, $P = A(1+i)^{-n}$

Effective Rate of Interest

$$r_{eff} = \left[1 + \frac{r}{m}\right]^m - 1$$

Future Value of an Annuity

$$S = R\left[\frac{(1+i)^n - 1}{i}\right]$$ (S = future value of ordinary annuity of n payments of R dollars periodic payment)

Present Value of an Annuity

$$P = R\left[\frac{1-(1+i)^{-n}}{i}\right]$$ (P = present value of ordinary annuity of n payments of R dollars periodic payment)

Amortization Formula

$$R = \frac{Pi}{1-(1+i)^{-n}}$$ (R = periodic payment on a loan of P dollars to be amortized over n periods)

Sinking Fund Formula

$$R = \frac{Si}{(1+i)^n - 1}$$ (R = periodic payment required to accumulate S dollars over n periods)

Basic Rules of Differentiation

(a) Chain rule: Derive $g[f(x)] = g'[f(x)]f'(x)$

(b) General power rule: Derive $[f(x)]^n = n[f(x)]^{n-1} f'(x)$

(c) Exponential function: Derive $e^x = e^x$

Derive $(e^u) = e^u[u'(x)]$

(d) Logarithmic function: Derive $\ln x = \frac{1}{x}$

Derive $(\ln u(x)) = \left(\frac{1}{u(x)}\right)[u'(x)]$

Basic Rules of Integration

(a) Exponential function: $\int e^{u} du = e^{u} + C$

(b) Logarithmic function: $\int \left(\frac{1}{u}\right) du = \ln u + C$

Determining Relative Extrema

$$D(x, y) = f_{xx} f_{yy} - (f_{xy})^2$$

If $D > 0$ and $f_{xx} > 0$, relative minimum point occurs at (x, y).
If $D > 0$ and $f_{xx} < 0$, relative maximum point occurs at (x, y).
If $D < 0$, (x, y) is neither maximum nor minimum.
If $D = 0$, the test is inconclusive.